TPM Access Utilities

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TPM: Primary source of telescope data

- The Sloan Digital Sky Survey's Telescope Performance Monitor serves out engineering data obtained from the Mount Control Computer.

- This data is presently written into a file on a workstation via NFS.

- *Problem: How to examine the data?*

- *Solution: The standard EPICS toolkit is used to provide network-based access to both archived and real-time TPM data.*

Overview of EPICS

- The Experimental Physics and Industrial Control System (EPICS) toolkit is the product of an on-going collaboration at over 100 international sites including many accelerator facilities and astronomical observatories.

- The EPICS toolkit creates a client-server architecture on the control system with communication handled by the channel access (CA) protocol.

- Channel access maintains a global name space of process variables within the local Internet sub-net.

- Clients and servers can exist on vxWorks, UNIX, and Win32 platforms.
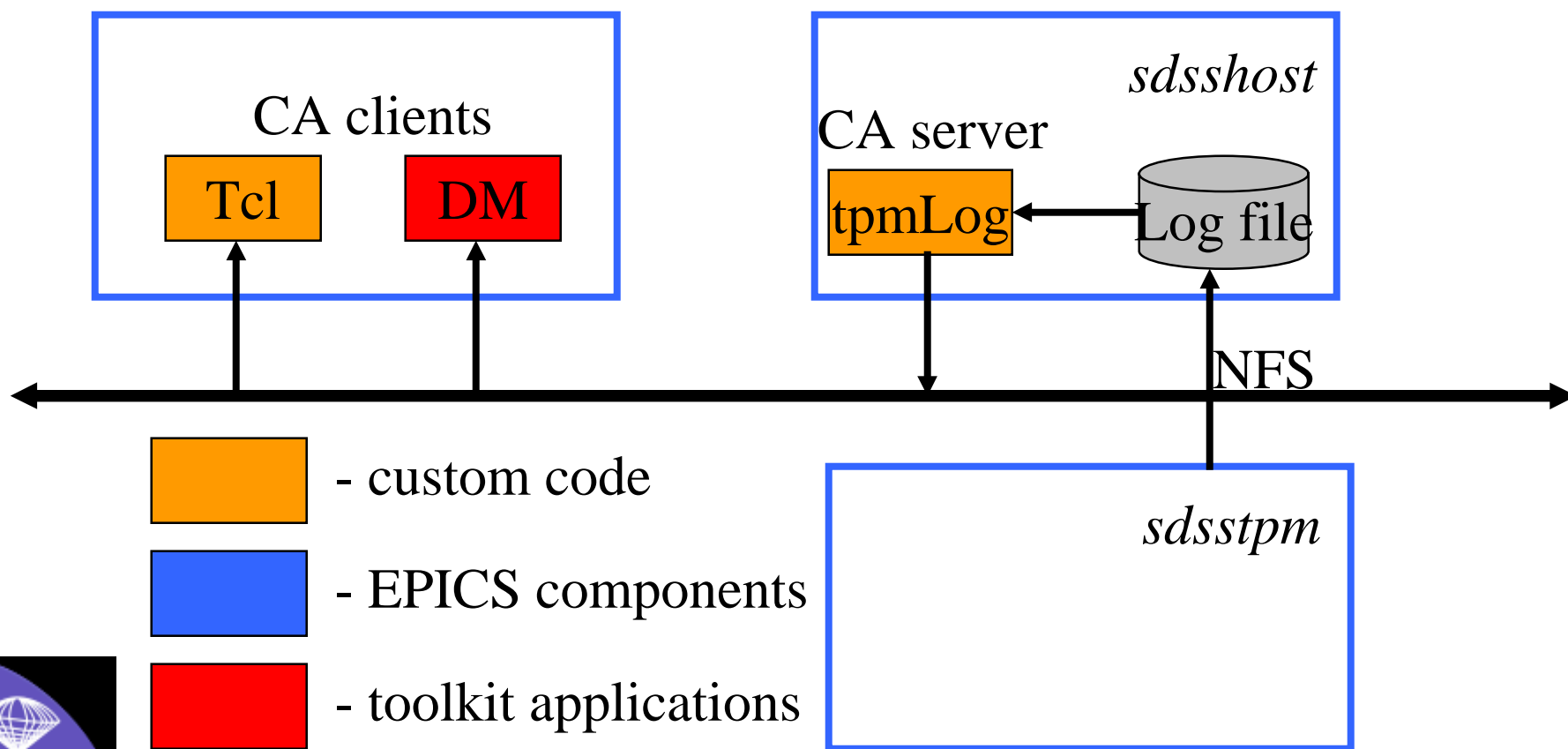
EPICS access to TPM data

- Solution 1: Create a custom workstation-based CA server that reads TPM log files.

- Solution 2: Create an EPICS database resident on the TPM IOC (Input-Output Controller) and serve live data using the supplied vxWorks-based CA server.

- Tools used:
  - EDD/DM: X-Windows based display editor and manager
  - StripTool: Generic stripchart tool with printing and export features
  - et_wish: merger of Tcl, Tk, Tcl-DP, and BLT with channel access client library
  - dct313: Tcl/Tk based real-time database creation tool

Solution 1: Logfile access

CA clients

sdsshost

CA server

| Tcl | DM |

tpmLog ← Log file

NFS

- custom code

- EPICS components

- toolkit applications

sdsstpm

Server architecture

- The toolkit supplied standard C++ base classes for server/network protocol and for the concept of a process variable.

- Custom C++ code needed to implement server and to create and associate named process variables with the underlying data store (the TPM log files).

- The server maps channel access get, put, and monitor commands onto TPM log file actions.

Server overview

- The client application can instruct the server to open a specific TPM log file.

- Once the file is open, the server can be queried to return information about the log file such as the sample rate and the number of registers archived.

- The client can determine what portion of the log file is read into the server's memory by specifying the start and end times from the start of the file.

- The time-series data is returned as a sequence of frames. The server supports the assignment of any TPM register including the timestamps to a "X" channel or any of four "Y" channels. Thus, plots of up to four registers against any other register are possible.

Custom server functions

- Open the named file

- Specify start and end time from beginning of file in seconds

- Initiate data reload

- Get the reload status

- Get the file sample rate

- Get number of registers in file

- Set frame size in samples

- Set the current frame number

- Set the X Register index

- Set the Y1-Y4 Register indices

- Get the current X Register frame
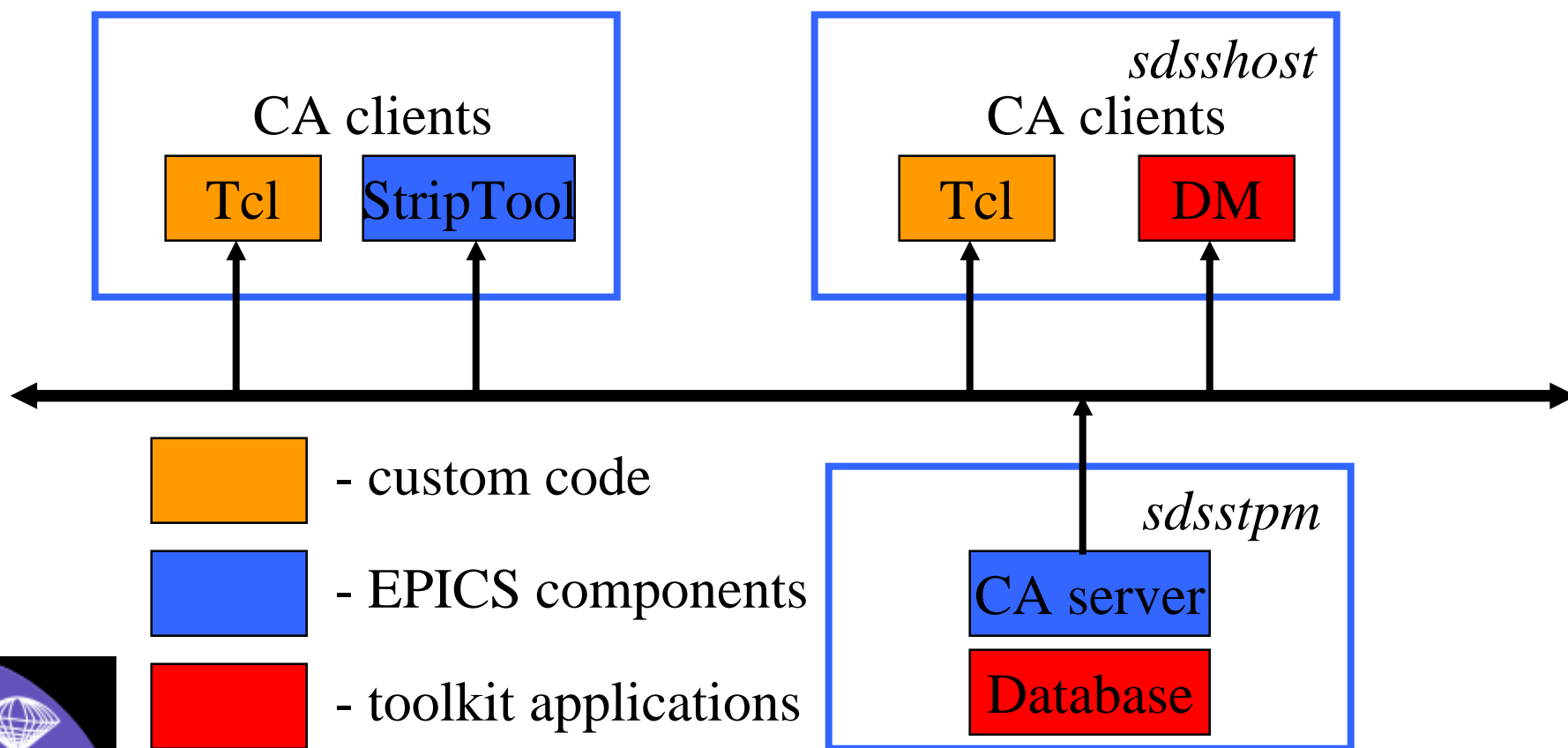
- Get the current Y1-Y4 Register frames

Two major client applications

- The user interface to the TPM log file data is implemented using a combination of two EPICS tools, DM and et_wish.

- EDD/DM provides the primary operator interface used to control the server configuration.
    - Opening the log file.
    - Loading data into memory
    - Specifying the registers to be returned

- The et_wish application is used to produce BLT graph widgets with interactive zooming.
    - Reads the "X" and the four "Y" process variables that are mapped to registers.

Solution 2: Real-time access

CA clients

Tcl   StripTool

sdsshost

CA clients

Tcl   DM

- custom code

- EPICS components

- toolkit applications

sdsstpm

CA server

Database

Real-time database is modular

- Channel access sees **Record.Field** as a single process variable and is not dependent on the database.

- Records come in standard types: binary in/out, analog in/out, calculation, waveforms, motor control, and many more.

- Records are processed on demand, at regular rates, by interrupts, or as the result of other records processing.

- Records can be linked together for input, output, and processing chains.

- Device support maps the record functionality into underlying device driver calls. This is typically a very thin layer.

The device drivers provide access to the physical I/O devices.

Real-time database functions

- SUBROUTINE record
  - Generic wrapper around user C code
  - Accesses shared memory and writes data into global vxWorks symbols
  - Scanned at 5Hz

- CALCULATION records
  - Computes axis position in degrees
  - Computes up-time

- LONGIN records
  - Uses EPICS vxWorks symbolic device support layer.
  - Maps Global symbols onto LONG integers
  - *No user C code*
  - Scanned at 5Hz

Example DM screen

ALTITUDE AXIS

Encoder 1:	267541 Counts
Encoder 2:	0 Counts
Voltage 1:	9 Counts
Current 1:	525 Counts
Voltage 2:	19 Counts
Current 2:	523 Counts

EXIT

Example StripTool screen
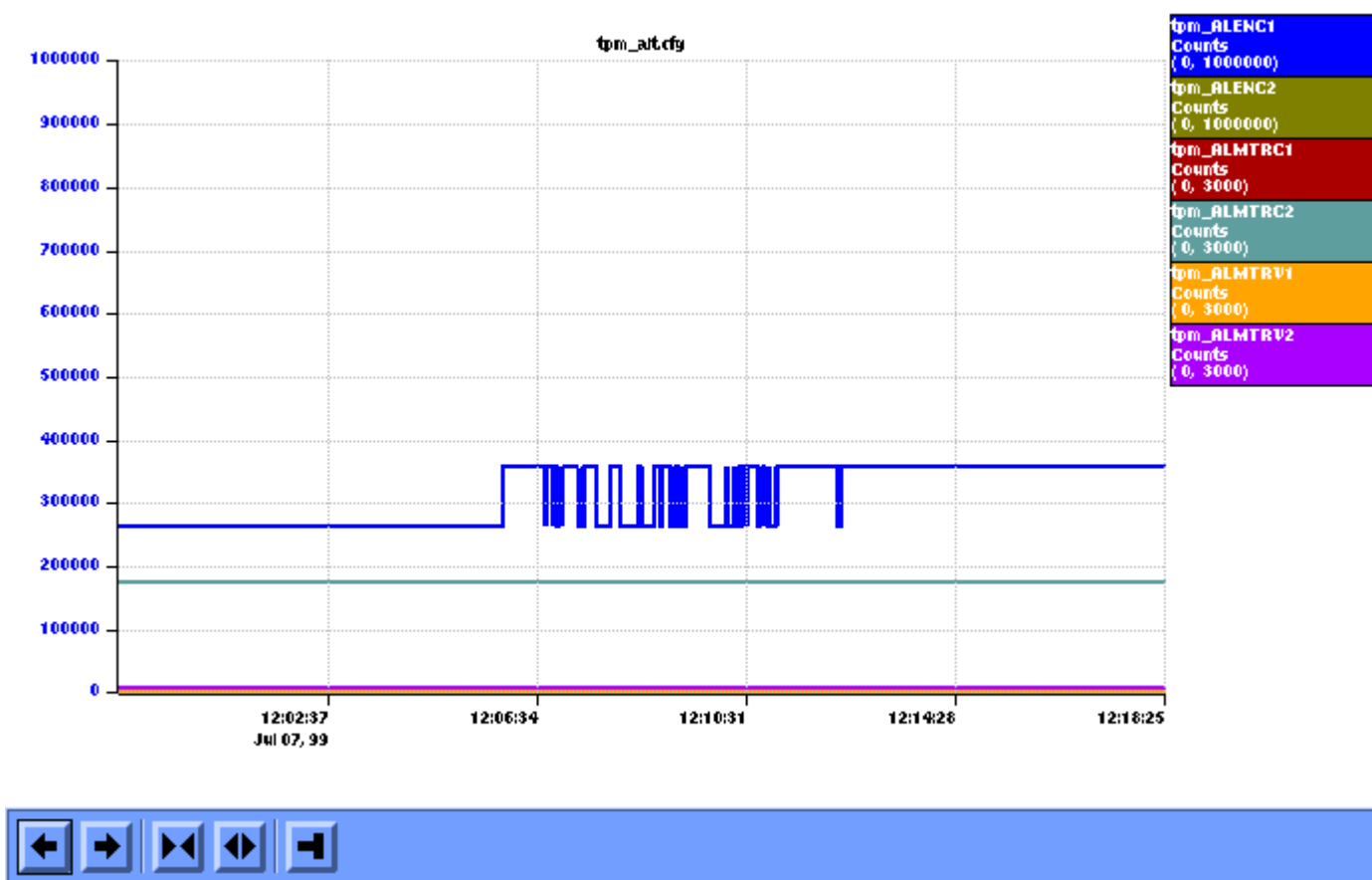
Discussion - 1

- While creation of the custom channel access server required significant C++ work, the real-time application development required only **four hours** to determine the hooks into the existing TPM software, create the SUBROUTINE record support, construct the database, and the initial displays.

- The TPM status records can be enhanced by defining upper and lower operating ranges and alarm limits and by creating a special device support layer instead of reliance on global vxWorks symbols.

- Other EPICS client applications can be installed at APO, including the alarm handler, the data archiver, and the X-windows based archive viewer.
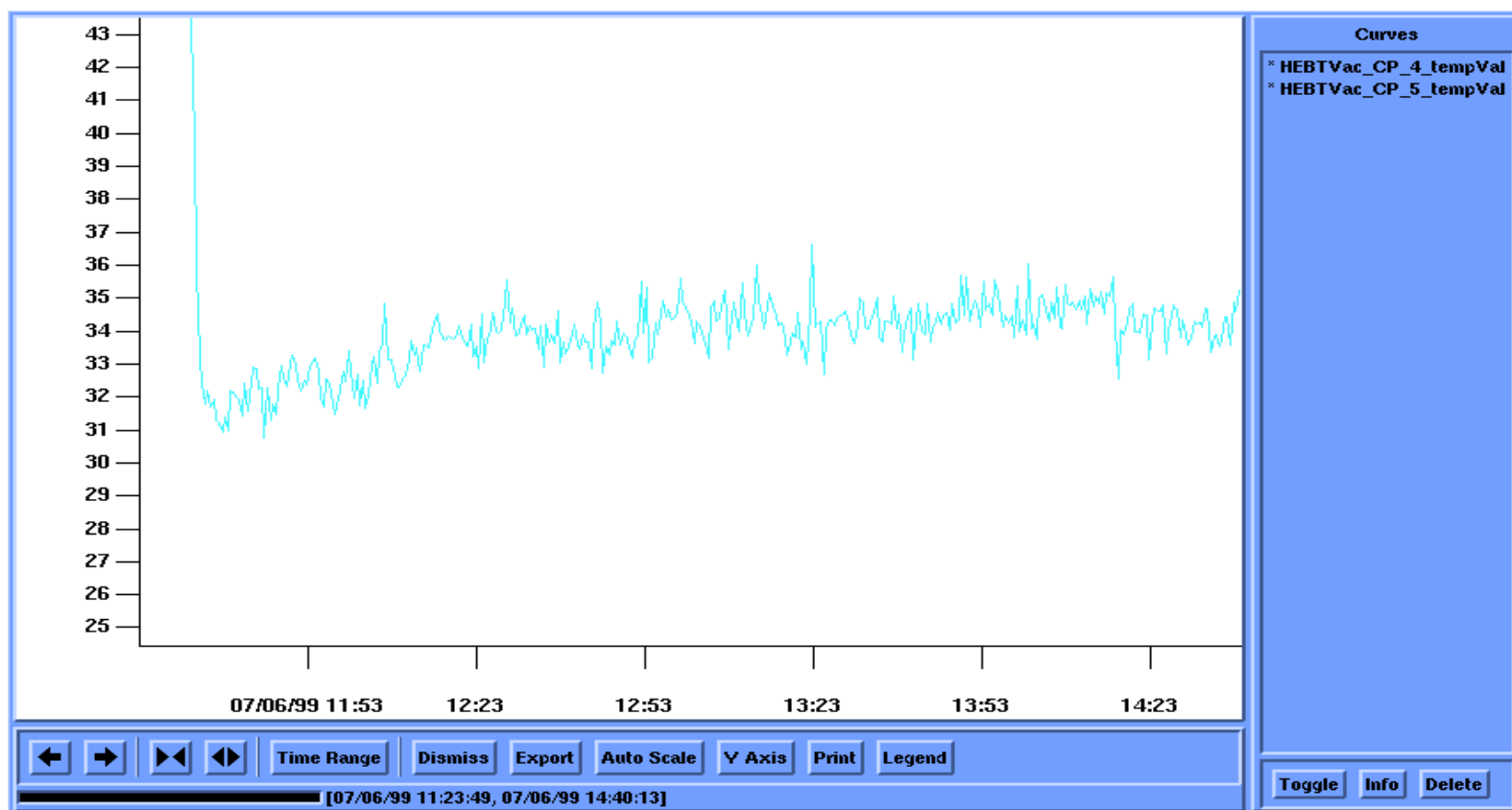
Discussion - 2

- After review of the custom channel access server application, the proposal is to make use of the modular design of the data archive viewer, XARR.

- XARR is presently used for retrieval and display of archived parameters. XARR also supports printing of displays and exporting into ASCII files. At LEDA/APT the accelerator physicists process these files using Excel.

- XARR can retrieve data from a variety of data sources, all of which described by classes derived from a fundamental data source base class. It would be relatively simple to create a data source class for TPM data.

XARR - Archive viewer